

D: Feb 13<sup>th</sup>, 2019.

10.

$$S(0) = 100$$

$$F_{0,1} = 110$$

Stock XYZ has a current price of 100. The forward price for delivery of this stock in 1 year is 110.

Unless otherwise indicated, the stock pays no dividends and the annual effective risk-free interest rate is 10%.

$$i = 0.10$$

Determine which of the following statements is FALSE.

- (A) The time-1 profit diagram and the time-1 payoff diagram for long positions in this forward contract are identical. **TRUE!** (for any forward)
- (B) The time-1 profit for a long position in this forward contract is exactly opposite to the time-1 profit for the corresponding short forward position. **TRUE!** (for any derivative)
- (C) There is no comparative advantage to investing in the stock versus investing in the forward contract. **TRUE!**
- (D) If the 10% interest rate was continuously compounded instead of annual effective, then it would be more beneficial to invest in the stock, rather than the forward contract.
- (E) If there was a dividend of 3.00 paid 6 months from now, then it would be more beneficial to invest in the stock, rather than the forward contract. **TRUE!**

Comparative advantage: a higher profit.

$$\begin{aligned} \text{Long Stock: Profit} &= S(T) - F_{0,1}(S(0)) \\ &= S(T) - 100 \cdot 1.1 = S(T) - 110 \end{aligned}$$

$$\text{Long Forward: Profit} = S(T) - 110 \quad \longrightarrow = \longleftarrow$$

More beneficial: a higher profit.

$$\left. \begin{aligned} \text{Long Stock: Profit} &= S(T) - 100 \cdot e^{0.10} \\ \text{Long Forward: Profit} &= S(T) - 110 \end{aligned} \right\} \Rightarrow \text{Long Forward has a higher profit}$$

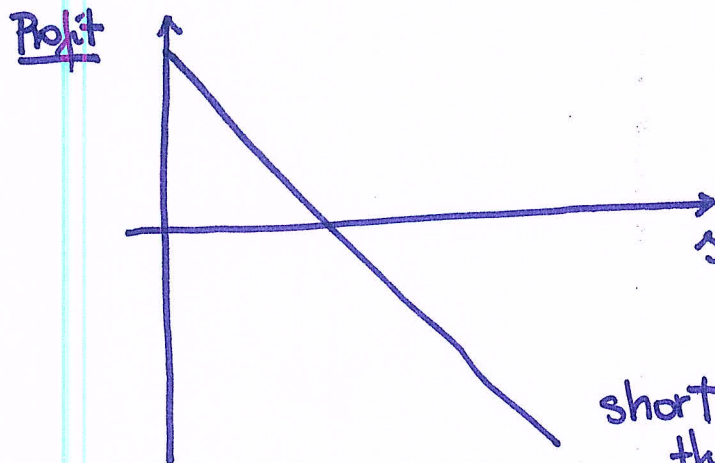
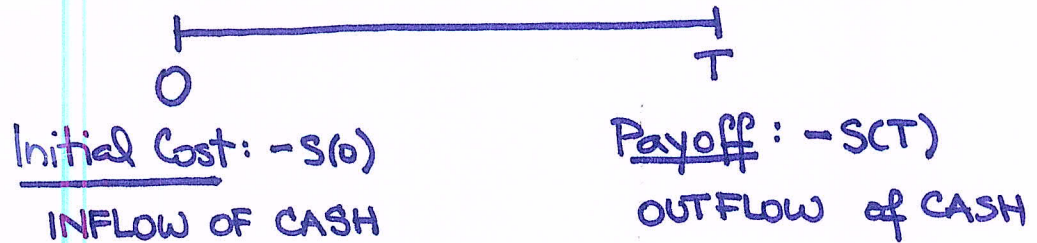
(D) FALSE :)

56.

Determine which of the following positions has the same cash flows as a short stock position.

Assume no dividends (for simplicity)!

- ✗ (A) Long forward and long zero-coupon bond
- ✗ (B) Long forward and short forward
- ✗ (C) Long forward and short zero-coupon bond
- (D) Long zero-coupon bond and short forward
- (E) Short forward and short zero-coupon bond



(A) long forward

+

long zero coupon bond

$$\frac{\text{bond cost}}{0}$$

P

↑  
bond price

Initial outflow  
of money!



Does NOT match!

$$\frac{\text{Init. Cost:}}{0}$$

Payoff:

$$S(T) - F$$

0

$$-S(T) + F$$

$$\frac{\quad}{0}$$

) +



Does NOT match!

(B) long forward

+

short forward

$$\frac{\text{Init. Cost:}}{0}$$

Payoff:

$$S(T) - F$$

0

$$-S(T) + F$$

$$\frac{\quad}{0}$$

) +



Does NOT match!

(C) long forward

+

short zero coupon bond

$$\frac{\text{Init. Cost}}{0}$$

$$\frac{\text{Payoff}}{S(T) - F}$$

$$-P$$

$$-C$$

↑  
redemption  
amt

Long w.r.t.  
the underlying

⇒ Does NOT match!

(D) long zero coupon bond

+

short forward

$$\frac{\text{Init. Cost}}{P}$$

$$\frac{0}{P}$$

Initial outflow  
of money ⇒

Does NOT match!

(E) Short forward

$$\frac{\text{initial cost}}{0}$$

$$\frac{\text{initial cost}}{F - S(T)}$$

+

short zero coupon bond

$$-P$$

$$-C$$

Match:

•  $P = S(0)$

$C = S(0)e^{rT}$

•  $F - S(T) - C = -S(T)$

$$F = S(0)e^{rT}$$

# Hedging w/ a Forward Contract.

\* Buyer / User of good (raw material) \*

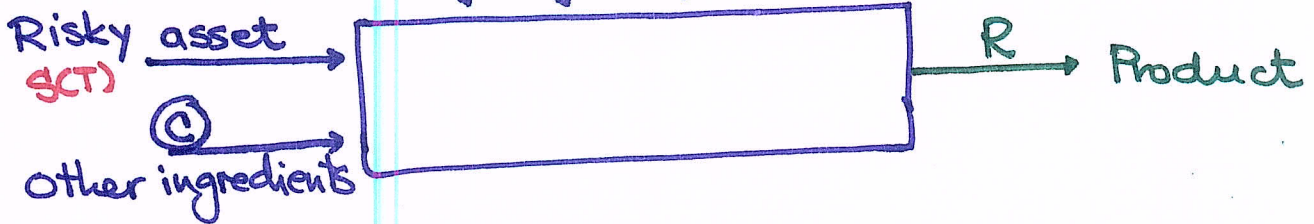
C... total & aggregate costs from the non-underlying asset sources  
 ↑ as before valued @ time T

R... "revenue"... the price @ which this agent can  
 ↑ sell the finished final product

← fix temporarity time T

SCT)... the market price of the underlying asset  
 @ the time it's needed

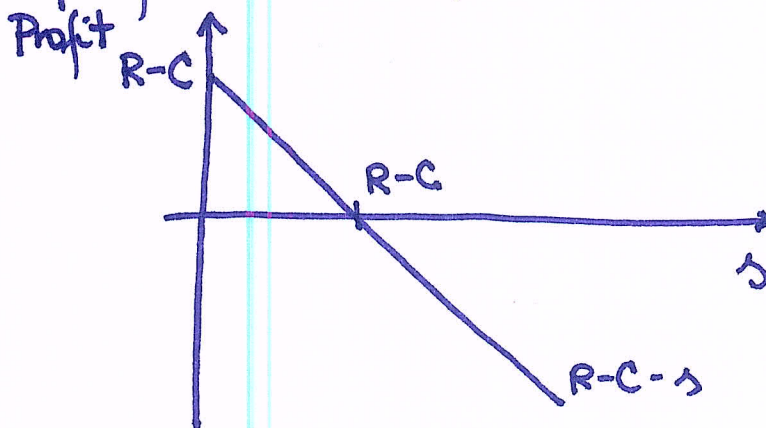
Making a final Product



Bottom line: Get R  
 Spend C  
 Spend SCT)

Profit :  $R - C - SCT)$  unhedged (★)

The profit curve of the unhedged position:



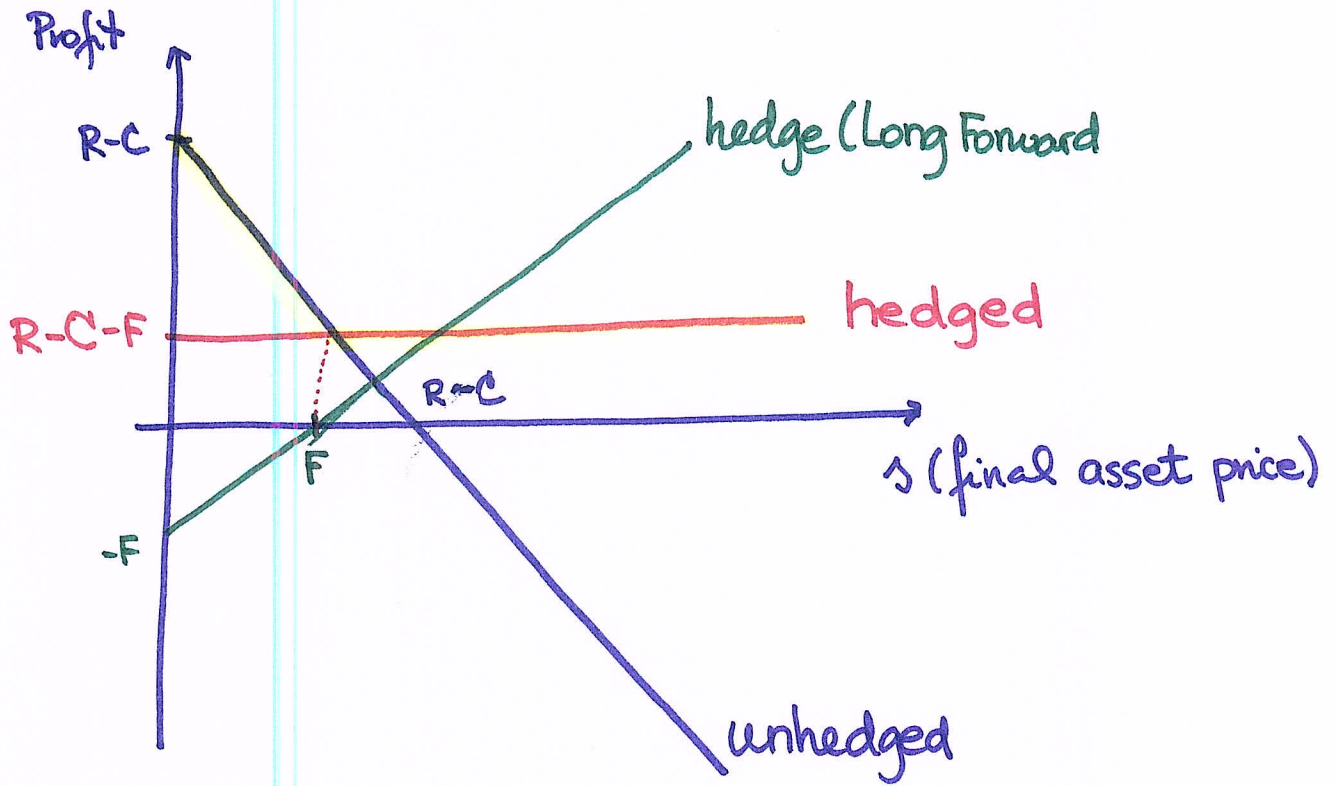
INHERENTLY  
SHORT position  
 w.r.t. the underlying

To hedge: Enter a long FORWARD CONTRACT

$$\text{Profit} = \text{Payoff} = S(T) - F \quad \text{hedge} \quad (\star\star)$$

The HEDGED POSITION:  $(\star) + (\star\star)$

$$R - C - S(T) + S(T) - F = R - C - F$$



\* The producer of goods \*

$C$ ... total aggregate costs (valued @ time  $T$ )

$S(T)$ ... the market price of the good @ time of sale  $T$

PROFIT

Unhedged:  $S(T) - C$

Hedge (<sup>SHORT</sup><sub>FORWARD</sub>):  $F - S(T)$

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Hedged position:  $F - C$



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Problem Set #4

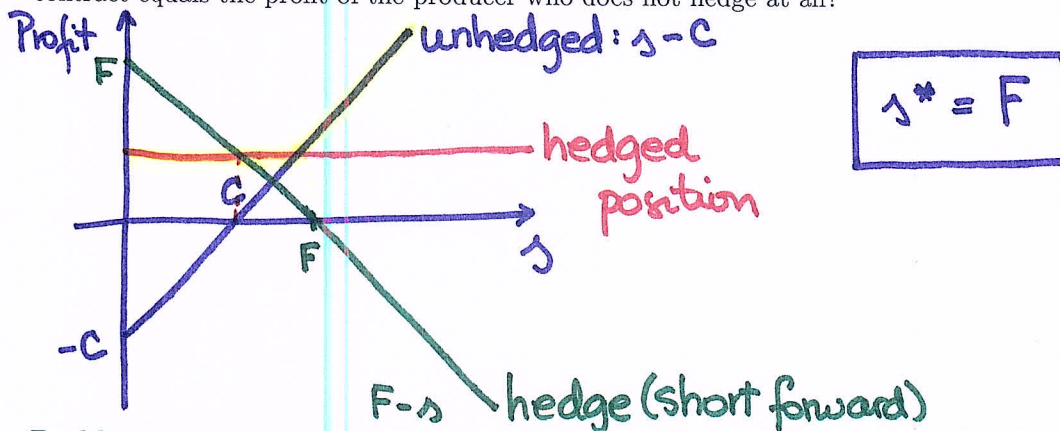
More on basic hedging. Forward contracts

4.1. Payoff and profit for a producer of goods who hedges using a forward contract.

Problem 4.1. Consider the general case in which

- $C$  stands for the total aggregate fixed and variable costs of production per unit of good;
- $F$  stands for the forward price per unit of good.

What is the price  $s^*$  per unit of good at which the profit of a producer who hedges using a forward contract equals the profit of the producer who does not hedge at all?



Problem 4.2. A farmer produces one million bushels of corn. The total cost of production is \$1.3 million. The farmer entered a forward contract to hedge at a forward price of \$2.50 per bushel on one million bushels. What is the farmer's profit?

Problem 4.3. Assume that farmer Brown is uncertain about his crop yield. Based on past experience, he thinks the following is a good model:

- 100,000 bushels with probability 1/4;
- 80,000 bushels with probability 3/4.



How many forward contracts do you think farmer Brown should short to hedge against fluctuations in corn prices at harvest time? Explain your way of thinking ...